**GCSE**

**wjec cbac**

**3300U60-1**

A21-3300U60-1

WEDNESDAY, 10 NOVEMBER 2021 – MORNING

**MATHEMATICS**
UNIT 2: CALCULATOR-ALLOWED
HIGHER TIER

1 hour 35 minutes

3300U601
01

**ADDITIONAL MATERIALS**

A calculator will be required for this examination.
A ruler, a protractor and a pair of compasses may be required.

**INSTRUCTIONS TO CANDIDATES**

Use black ink or black ball-point pen. Do not use gel pen or correction fluid.

You may use a pencil for graphs and diagrams only.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** the questions in the spaces provided.

If you run out of space, use the additional page at the back of the booklet. Question numbers must be given for all work written on the additional page.

Take π as 3·14 or use the π button on your calculator.

**INFORMATION FOR CANDIDATES**

You should give details of your method of solution when appropriate.

Unless stated, diagrams are not drawn to scale.

Scale drawing solutions will not be acceptable where you are asked to calculate.

The number of marks is given in brackets at the end of each question or part-question.

In question **9**, the assessment will take into account the quality of your linguistic and mathematical organisation, communication and accuracy in writing.

| For Examiner's use only | | |
|---|---|---|
| **Question** | **Maximum Mark** | **Mark Awarded** |
| **1.** | 3 | |
| **2.** | 4 | |
| **3.** | 4 | |
| **4.** | 5 | |
| **5.** | 3 | |
| **6.** | 9 | |
| **7.** | 3 | |
| **8.** | 3 | |
| **9.** | 5 | |
| **10.** | 6 | |
| **11.** | 3 | |
| **12.** | 7 | |
| **13.** | 4 | |
| **14.** | 8 | |
| **15.** | 3 | |
| **Total** | 70 | |

CJ*(A21-3300U60-1)

# Formula List – Higher Tier

**Area of trapezium** $= \frac{1}{2}(a + b)h$
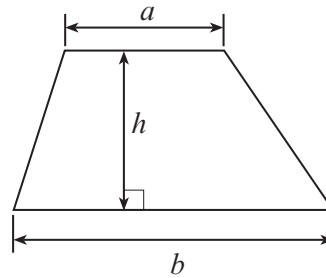
**Volume of prism** = area of cross-section × length
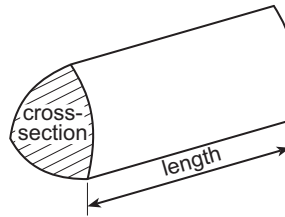
**Volume of sphere** $= \frac{4}{3}\pi r^3$

**Surface area of sphere** $= 4\pi r^2$
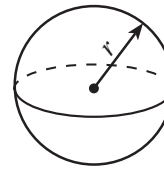
**Volume of cone** $= \frac{1}{3}\pi r^2 h$

**Curved surface area of cone** $= \pi r l$
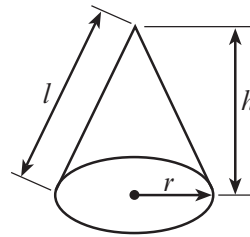
**In any triangle** $ABC$

    **Sine rule**    $\dfrac{a}{\sin A} = \dfrac{b}{\sin B} = \dfrac{c}{\sin C}$

    **Cosine rule**    $a^2 = b^2 + c^2 - 2bc\cos A$

    **Area of triangle** $= \frac{1}{2}ab\sin C$
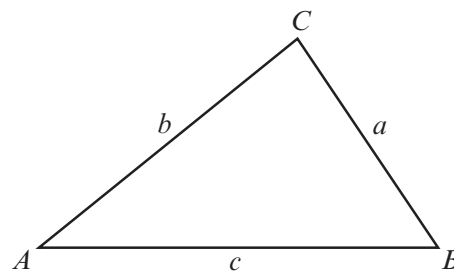
## The Quadratic Equation

The solutions of $ax^2 + bx + c = 0$ where $a \neq 0$ are given by     $x = \dfrac{-b \pm \sqrt{(b^2 - 4ac)}}{2a}$

## Annual Equivalent Rate (AER)

AER, as a decimal, is calculated using the formula $\left(1 + \dfrac{i}{n}\right)^n - 1$, where $i$ is the nominal interest rate

per annum as a decimal and $n$ is the number of compounding periods per annum.

   (3300U60-1)

**1.** A rectangle has sides of length $2(3a - 7)$ cm and $(5a + 4)$ cm.

$2(3a - 7)$ cm

$(5a + 4)$ cm
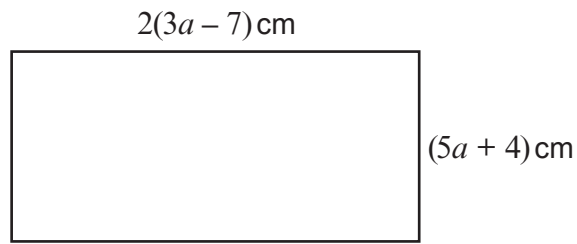
*Diagram not drawn to scale*

Form an expression, in terms of $a$, for the perimeter of this rectangle.
You must simplify your expression. [3]

..........................................................................................................................................................

..........................................................................................................................................................

..........................................................................................................................................................

..........................................................................................................................................................

..........................................................................................................................................................

..........................................................................................................................................................

(3300U60-1) **Turn over.**

**2.** A company has two sites.
One is in North Wales and the other is in South Wales.

The pie charts below show the distribution of its 96 part-time staff and its 150 full-time staff.



96 part-time staff                    150 full-time staff

A person is chosen at random from the company's 246 staff members.
What is the probability that this person works at the site in North Wales? [4]

....................................................................................................................................................................

....................................................................................................................................................................

....................................................................................................................................................................

....................................................................................................................................................................

....................................................................................................................................................................

....................................................................................................................................................................

....................................................................................................................................................................

....................................................................................................................................................................

....................................................................................................................................................................

....................................................................................................................................................................

....................................................................................................................................................................

....................................................................................................................................................................

....................................................................................................................................................................

....................................................................................................................................................................

(3300U60-1)

**3.** A solution of the equation

$$x^3 + 3x = 20$$

lies between 2 and 3.

Use the method of trial and improvement to find this solution correct to 1 decimal place. You must show all your working. [4]

© WJEC CBAC Ltd. (3300U60-1)

**Turn over.**

3300U601 05

**4.** Show that the triangle below is **not** a right-angled triangle. [5]



*Diagram not drawn to scale*

...........................................................................................................................................................

...........................................................................................................................................................

...........................................................................................................................................................

...........................................................................................................................................................

...........................................................................................................................................................

...........................................................................................................................................................

...........................................................................................................................................................

...........................................................................................................................................................

...........................................................................................................................................................

...........................................................................................................................................................

...........................................................................................................................................................

...........................................................................................................................................................

...........................................................................................................................................................

...........................................................................................................................................................

...........................................................................................................................................................

...........................................................................................................................................................

(3300U60-1)

**5.** Calculate the length of the side *AB* in the triangle shown below. [3]



*Diagram not drawn to scale*

© WJEC CBAC Ltd. (3300U60-1) **Turn over.**
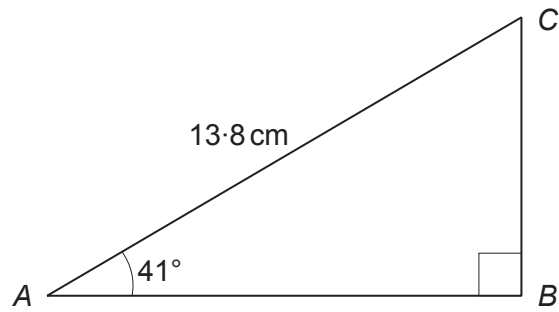
**6.** *(a)* (i) Expand $x(x^2 + 7)$. [2]

..................................................................................................................................................

(ii) Expand and simplify $(x - 5)(3x - 4)$. [2]

..................................................................................................................................................

..................................................................................................................................................

..................................................................................................................................................

*(b)* Sarah buys and sells antique clocks.
On Monday, Sarah had $n$ clocks.
At the end of the day on Tuesday, she had 5 times as many clocks as she had on Monday.
On Wednesday, she sold 27 clocks.

(i) At the end of the day on Wednesday, Sarah had fewer clocks than she had on Monday.
Write an inequality, in terms of $n$, that shows this information. [2]

..................................................................................................................................................

..................................................................................................................................................

..................................................................................................................................................

(ii) Solve your inequality to find the greatest number of clocks that Sarah could have had on the Monday. [3]

..................................................................................................................................................

..................................................................................................................................................

..................................................................................................................................................

..................................................................................................................................................

..................................................................................................................................................

..................................................................................................................................................

..................................................................................................................................................

..................................................................................................................................................

(3300U60-1)

**7.** *(a)* A number, when increased by 4%, is equal to $N$.
Which of the following calculations would give you the original number?
Circle your answer. [1]

$$N \times 1{\cdot}04 \qquad N \div 1{\cdot}04 \qquad N \times 1{\cdot}4 \qquad N \div 1{\cdot}4 \qquad N - 4$$

*(b)* The number shown on each diagram below is 20% greater than the number shown on the previous diagram.



Diagram 1     Diagram 2     Diagram 3

*Diagram not drawn to scale*
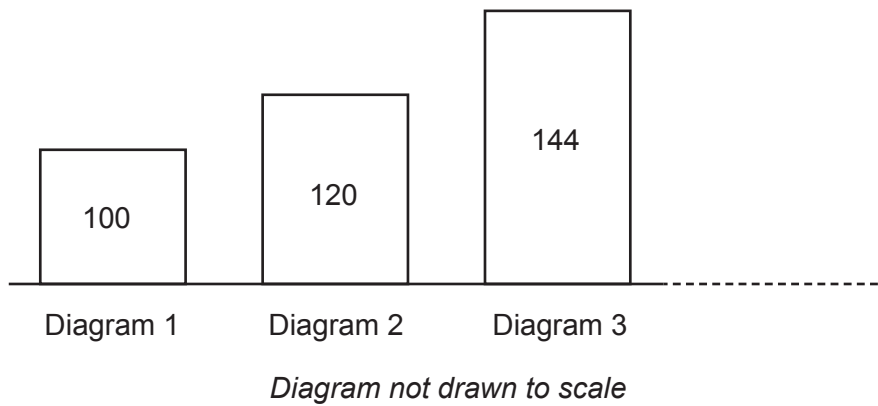
Find the number that should be shown on Diagram 6. [2]

**8.** Factorise $x^2 - 4x - 12$, and hence solve $x^2 - 4x - 12 = 0$. [3]

**9.** *In this question, you will be assessed on the quality of your organisation, communication and accuracy in writing.*

A circle with centre *O* is shown below.
The radius of the circle is 7·3 cm.
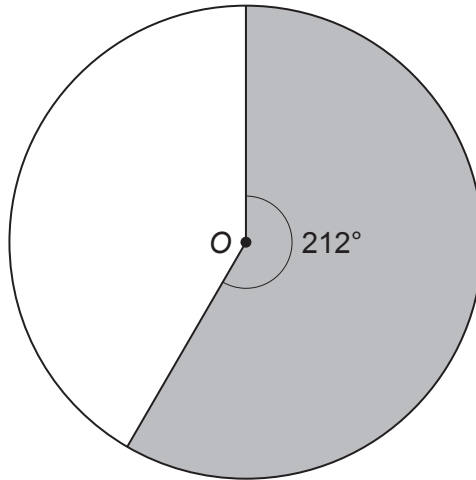


*Diagram not drawn to scale*

Calculate the perimeter of the shaded region.
You must show all your working.                    [3 + 2 OCW]

...................................................................................................................................................................

...................................................................................................................................................................

...................................................................................................................................................................

...................................................................................................................................................................

...................................................................................................................................................................

...................................................................................................................................................................

...................................................................................................................................................................

...................................................................................................................................................................

...................................................................................................................................................................

...................................................................................................................................................................

...................................................................................................................................................................

...................................................................................................................................................................

...................................................................................................................................................................

**Turn over.**

**10.** *(a)* (i) You are given that $y$ is **inversely** proportional to $\sqrt{x}$ .
$y = 65$ when $x = 51 \cdot 84$.
Find an expression for $y$ in terms of $x$. [3]

..................................................................................................................................................

..................................................................................................................................................

..................................................................................................................................................

..................................................................................................................................................

..................................................................................................................................................

..................................................................................................................................................

..................................................................................................................................................

(ii) Use the expression you found in part (i) to complete the following table. [2]

| $x$ | 51·84 | 15·21 | |
|---|---|---|---|
| $y$ | 65 | | 78 |

..................................................................................................................................................

..................................................................................................................................................

..................................................................................................................................................

..................................................................................................................................................

..................................................................................................................................................

*(b)* It is known that $c$ is **directly** proportional to the square of $d$.
What happens to $c$ if $d$ is doubled?
Circle the correct statement below. [1]

| $c$ is divided by 2 | $c$ is multiplied by 2 | $c$ is divided by 4 | $c$ is multiplied by 4 | $c$ is squared |
|---|---|---|---|---|

..................................................................................................................................................

..................................................................................................................................................

© WJEC CBAC Ltd. (3300U60-1)

**11.** The table below shows the value of $d$ and the value of $e$.
It also shows the degree of accuracy of each value.

| Value | Degree of accuracy |
|-------|--------------------|
| $d$ = 64 | Nearest whole number |
| $e$ = 8·6 | 1 decimal place |

Use the formula

$$c = \frac{d^2}{e}$$

to calculate the **least** possible value of $c$.

You must show all your working. [3]

........................................................................................................................................................................

........................................................................................................................................................................

........................................................................................................................................................................

........................................................................................................................................................................

........................................................................................................................................................................

........................................................................................................................................................................

........................................................................................................................................................................

........................................................................................................................................................................

© WJEC CBAC Ltd. (3300U60-1) **Turn over.**

**12.** The diagram shows a quadrilateral *DEFG*.



*Diagram not drawn to scale*

Calculate the size of $\widehat{EFG}$. [7]

........................................................................................................................................................

........................................................................................................................................................

........................................................................................................................................................

........................................................................................................................................................

........................................................................................................................................................

........................................................................................................................................................

........................................................................................................................................................

........................................................................................................................................................

........................................................................................................................................................

........................................................................................................................................................

........................................................................................................................................................

........................................................................................................................................................

........................................................................................................................................................

........................................................................................................................................................

(3300U60-1)

**13.** Simplify the following expression. [4]

$$\frac{6x^2 - 9x}{4x^2 - 9}$$

......................................................................................................................................................

......................................................................................................................................................

......................................................................................................................................................

......................................................................................................................................................

......................................................................................................................................................

......................................................................................................................................................

......................................................................................................................................................

......................................................................................................................................................

......................................................................................................................................................

......................................................................................................................................................

......................................................................................................................................................

(3300U60-1)

**Turn over.**

**14.** Triangle *ABC* is shown below.

The length of *AC* is $(x - 1)$ cm.

The length of *BC* is $(2x + 3)$ cm.

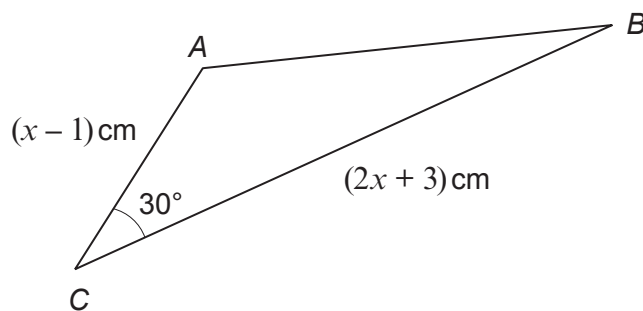The size of $\widehat{ACB}$ is 30°.

The area of triangle *ABC* is 6 cm².

A

B

$(x - 1)$ cm

$(2x + 3)$ cm

30°

C

*Diagram not drawn to scale*

*(a)* Show that [3]

$$2x^2 + x - 27 = 0.$$

............................................................................................................................................................

............................................................................................................................................................

............................................................................................................................................................

............................................................................................................................................................

............................................................................................................................................................

............................................................................................................................................................

............................................................................................................................................................

............................................................................................................................................................

............................................................................................................................................................

............................................................................................................................................................

(3300U60-1)

(b) Solve the equation

$$2x^2 + x - 27 = 0.$$

You must use an algebraic method and show all your working.
Give your answers correct to 2 decimal places. [3]

..........................................................................................................................................................

..........................................................................................................................................................

..........................................................................................................................................................

..........................................................................................................................................................

..........................................................................................................................................................

..........................................................................................................................................................

..........................................................................................................................................................

..........................................................................................................................................................

..........................................................................................................................................................

(c) Evaluate the length of *AC*.
You must justify any decision that you make. [2]

..........................................................................................................................................................

..........................................................................................................................................................

..........................................................................................................................................................

..........................................................................................................................................................

..........................................................................................................................................................

(3300U60-1)

**Turn over.**

**15.** The following diagram shows a sketch of the curve $y = f(x)$.
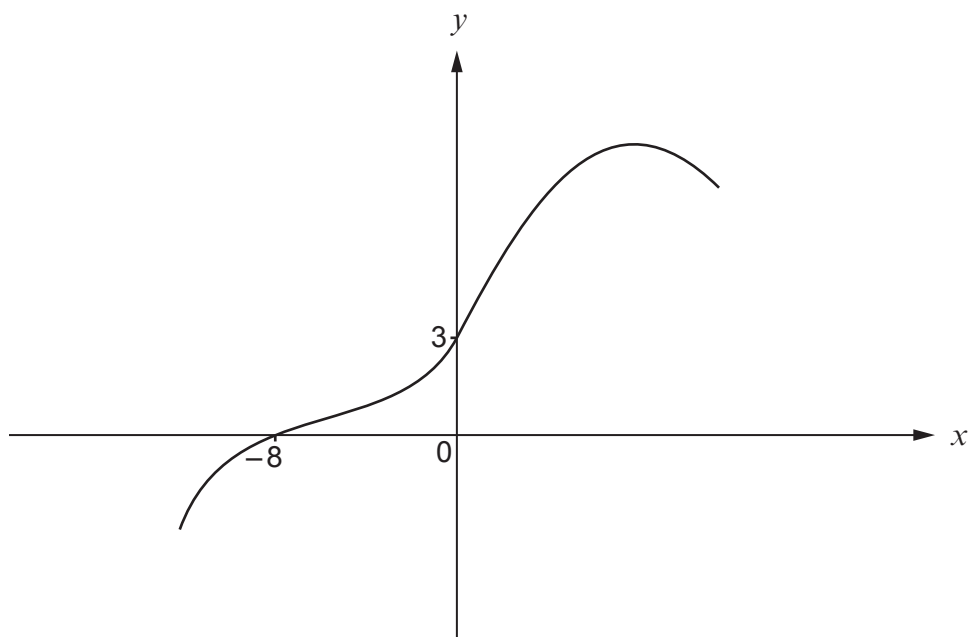


In each of the following questions, the graph of $y = f(x)$ has been transformed.

*(a)*
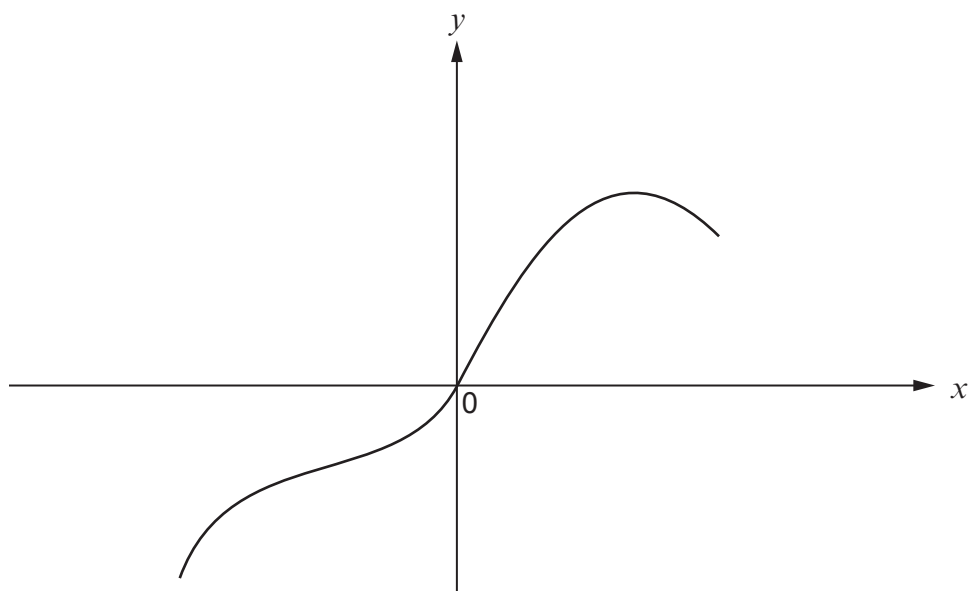


Circle the only possible equation of the transformed curve. [1]

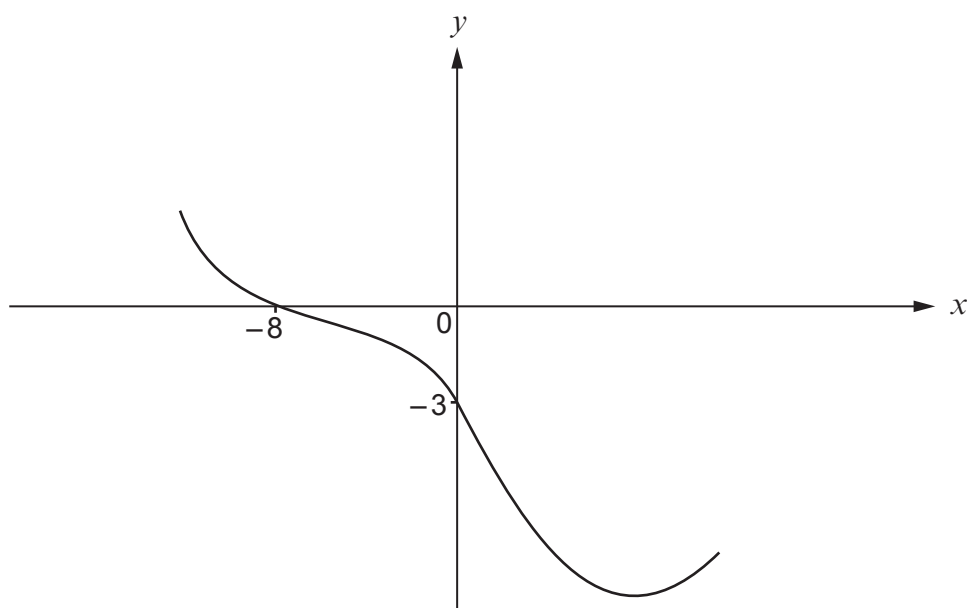$y = f(x) - 3$     $y = f(x - 3)$     $y = \frac{1}{3} f(x)$     $y = f(x + 3)$     $y = f(x) + 3$

(3300U60-1)

*(b)*



Circle the only possible equation of the transformed curve. [1]
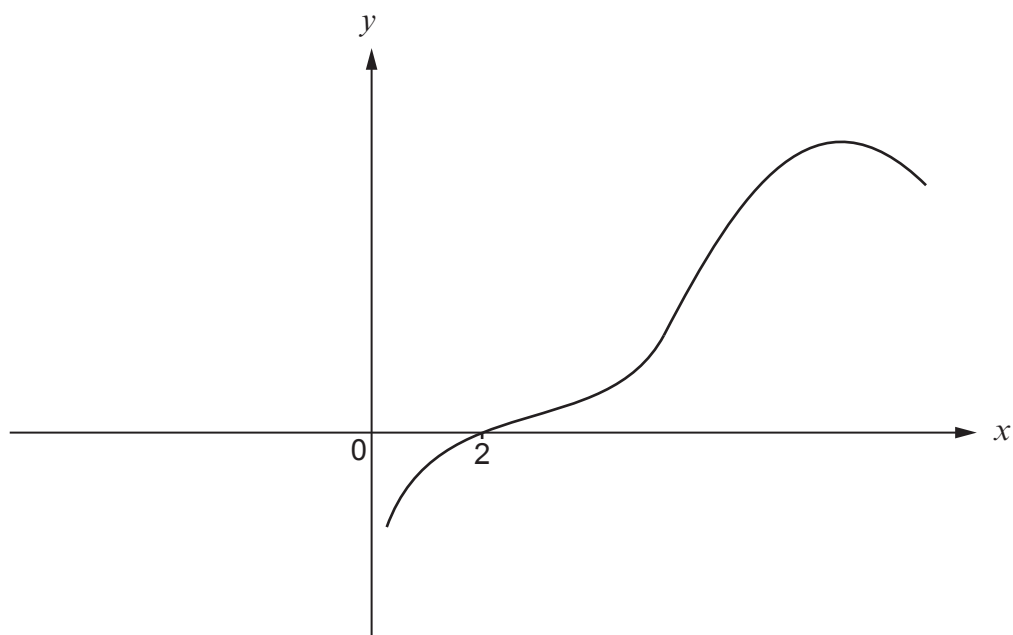
$y = f(x) - 6$      $y = -f(x)$      $y = f(x + 8)$      $y = f(x) + 6$      $y = f(-x)$

*(c)*



Circle the only possible equation of the transformed curve. [1]

$y = f(x) + 10$      $y = f(x + 10)$      $y = -4f(x)$      $y = f(x - 10)$      $y = f(x) - 10$

**END OF PAPER**

(3300U60-1)

| Question number | Additional page, if required.<br>Write the question number(s) in the left-hand margin. | Examiner only |
|---|---|---|
| | | |

(3300U60-1)